**WHAT IS CLAIMED IS:**

Sub a1

1. An optical communications network transmitting signals on multiple wavelengths, the optical communications network comprising:

a first dispersion compensating fiber providing dispersion compensation and dispersion slope compensation, said first dispersion compensating fiber having a first non-zero dispersion coefficient and a first non-zero dispersion slope coefficient;

a second dispersion compensating fiber in optical communication with said first dispersion compensating fiber, said second dispersion compensating fiber having a second non-zero dispersion coefficient and a second non-zero dispersion slope coefficient, a length of said first dispersion compensating fiber and a length said second dispersion compensating fiber are selected to compensate dispersion and compensate dispersion slope simultaneously for the multiple wavelengths in a transmission path in optical communication with said first dispersion compensating fiber and said second dispersion compensating fiber.

2. The optical communications network of claim 1 wherein the first non-zero dispersion coefficient is different from the second non-zero dispersion coefficient.

3. The optical communications network of claim 1 wherein the first non-zero dispersion slope coefficient is different from the second non-zero dispersion slope coefficient.

4. The optical communications network of claim 1 wherein the transmission path is an inter-network element section of transmission fiber.

5. The optical communications network of claim 4 wherein the transmission path includes a component in optical communication with the inter-network element section of transmission fiber.

6. The optical communications network of claim 4 wherein said first dispersion compensating fiber and said second dispersion compensating fiber are housed in a single dispersion compensation module.

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7. The optical communications network of claim 1 wherein the transmission path extends between a first terminal to a second terminal to define a terminal-to-terminal path.

8. The optical communications network of claim 7 wherein the transmission path includes a component in optical communication with the terminal-to-terminal path.

9. The optical communications network of claim 7 wherein said first dispersion compensating fiber and said second dispersion compensating fiber are housed in separate dispersion compensation modules.

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10. The optical communications network of claim 1 wherein the length of first dispersion compensating fiber and the length of second dispersion compensating fiber are selected based on a mathematical solution compensating dispersion in the transmission path and compensating dispersion slope in the transmission path.

11. The optical communications network of claim 10 wherein the mathematical solution is represented as:

$$D_{trans} * L_{trans} + D_{dcf1} * L_{dcf1} + D_{dcf2} * L_{dcf2} = 0$$

$$L_{trans} * S_{trans} + L_{dcf1} * S_{dcf1} + L_{dcf2} * S_{dcf2} = 0$$

where D is dispersion coefficient, L is length and S is dispersion slope coefficient.

12. The optical communications network of claim 11 wherein the length of first dispersion compensating fiber and the length of second dispersion compensating fiber are selected based on discrete lengths approximating the mathematical solution.

13. The optical communications network of claim 10 wherein the mathematical solution compensates for Nth order dispersion effects in the transmission path, where N is greater than 2.

14. The optical communications network of claim 10 wherein the mathematical solution includes a value representing dispersion introduced by components in the transmission path.

15. The optical communications network of claim 10 wherein the mathematical solution includes a value representing dispersion slope introduced by components in the transmission path.

16. A method for compensating dispersion in an optical communications network transmitting signals on multiple wavelengths, the method:

providing first non-zero dispersion compensation and first non-zero dispersion slope compensation;

providing second non-zero dispersion compensation and second non-zero dispersion slope compensation;

said first non-zero dispersion compensation, first non-zero dispersion slope compensation, second non-zero dispersion compensation and second non-zero dispersion slope compensation selected to compensate dispersion and compensate dispersion slope simultaneously for the multiple wavelengths in a transmission path.

17. The method of claim 16 wherein the first non-zero dispersion compensation is different from the second non-zero dispersion compensation.

18. The method of claim 16 wherein the first non-zero dispersion slope compensation is different from the second non-zero dispersion slope compensation.

19. The method of claim 16 wherein the transmission path is an inter-network element section of transmission fiber.

20. The method of claim 19 wherein the transmission path includes a component in optical communication with the inter-network element section of transmission fiber.

21. The method of claim 16 wherein the transmission path extends between a first terminal to a second terminal to define a terminal-to-terminal path.

22. The method of claim 21 wherein the transmission path includes a component in optical communication with the terminal-to-terminal path.

23. The method of claim 16 wherein the first non-zero dispersion compensation, first non-zero dispersion slope compensation, second non-zero dispersion compensation and second non-zero dispersion slope compensation are selected based on a mathematical solution

compensating dispersion in the transmission path and compensating dispersion slope in the transmission path.

24. The method of claim 23 wherein the mathematical solution is represented as:

$$D_{trans} * L_{trans} + D_{dcf1} * L_{dcf1} + D_{dcf2} * L_{dcf2} = 0$$

$$L_{trans} * S_{trans} + L_{dcf1} * S_{dcf1} + L_{dcf2} * S_{dcf2} = 0$$

where D is dispersion coefficient, L is length and S is dispersion slope coefficient.

25. The method of claim 23 wherein the first non-zero dispersion compensation, first non-zero dispersion slope compensation, second non-zero dispersion compensation and second non-zero dispersion slope compensation are selected based on discrete lengths approximating the mathematical solution.

26. The method of claim 23 wherein the mathematical solution compensates for Nth order dispersion effects in the transmission path, where N is greater than 2.

27. The method of claim 23 wherein the mathematical solution includes a value representing dispersion introduced by components in the transmission path.

28. The method of claim 23 wherein the mathematical solution includes a value representing dispersion slope introduced by components in the transmission path.